VECTOR DISPLAYS

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A NEW STATE-OF-THE-ART
IN REFRESHED VECTOR GRAPHICS
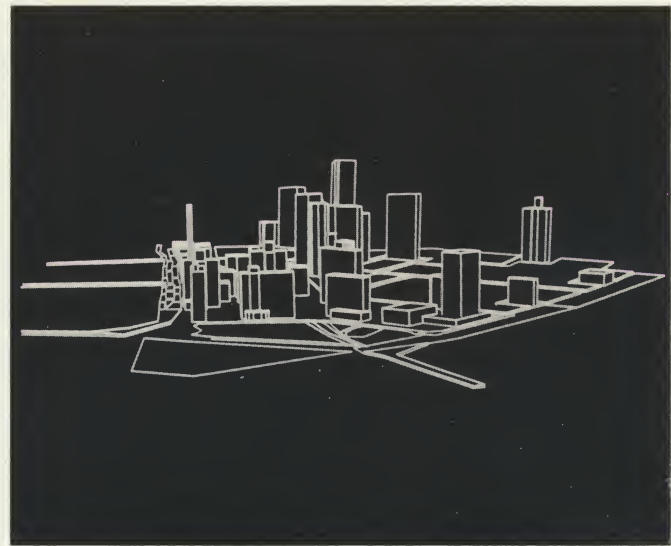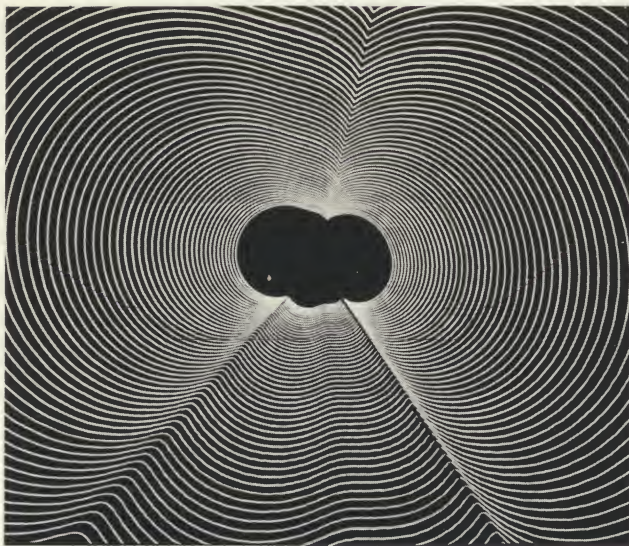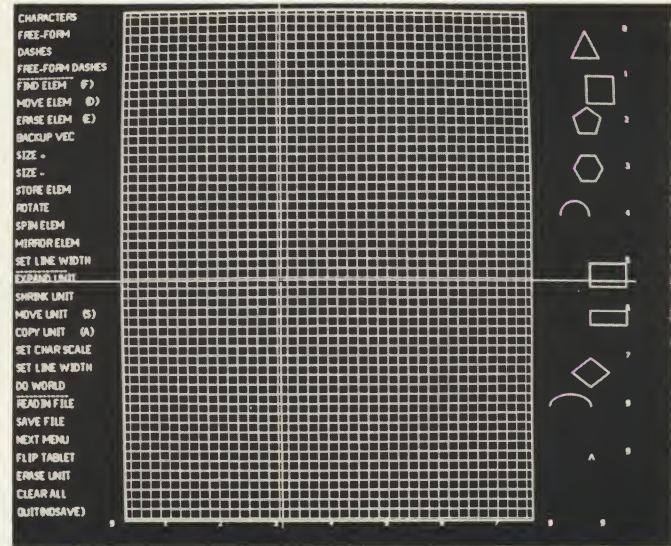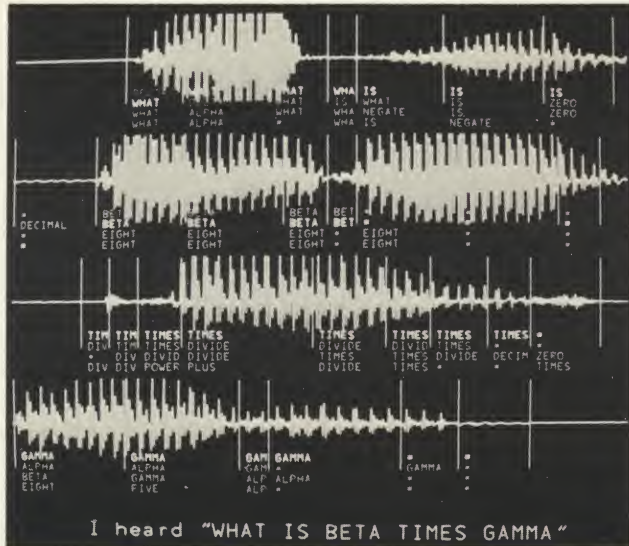
THREE RIVERS COMPUTER CORP.

The time has come for . . . .

- enough capacity for 100,000 tenth-inch vectors at 30 Hz refresh
- user defined character sets with no restrictions
- compact, efficient control instructions in the display list
- high bandwidth double ported refresh memory
- stable, completely digital vector generator
- perfect end-point closure
- efficient formats that pack two vectors in a single 16-bit word
- hardware scaling in 25% increments rather than 2:1 jumps

Three Rivers presents the GDP/2A, a vector graphics display with performance that establishes a new state-of-the-art. With the GDP/2A it is possible to draw flicker free pictures of exceptional complexity: intricately detailed structures, large numbers of smooth curves, or pages of text with elaborate type faces. The GDP/2A provides enough display capability to draw refreshed pictures that until now could only be drawn by storage tube technology.

ARCHITECTURE

The complete display terminal consists of the following components:

- the GDP/2A graphic display processor which directly executes tree structured graphic data
- a 19-inch diagonal cathode ray tube utilizing electrostatic deflection
- a 16K or 32K word double ported refresh memory which minimizes bus contention and overhead between the GDP/2A and the minicomputer
- a PDP-11® minicomputer
- keyboards, tablets, and other peripherals as required

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┌─────────────────┐      ┌─────────────────┐                    ┌──────┐
│ DOUBLE PORTED   │─────▶│    GDP/2A       │────────── ℈℈ ─────▶│ 19″  │
│ REFRESH MEMORY  │      │ GRAPHICS PROCESSOR │                  │ CRT  │
└─────────────────┘      └─────────────────┘                    └──────┘
         │                                                   ┌────────────┐
         │                                                   │  KEYBOARD  │
─────────┼────────────────── UNIBUS® ──────────────────┐    └────────────┘
         │        │              │            │         │
┌────────┐ ┌────────────┐ ┌────────────┐ ┌────────────┐ ┌────────────────┐
│TO/FROM │ │  OPTIONAL  │ │   PDP-11   │ │  STANDARD  │ │ THREE RIVERS   │
│ HOST   │─│ HOST LINK  │ │ MINICOMPUTER│ │ PERIPHERALS│ │  INTERFACE     │
└────────┘ └────────────┘ └────────────┘ └────────────┘ └────────────────┘
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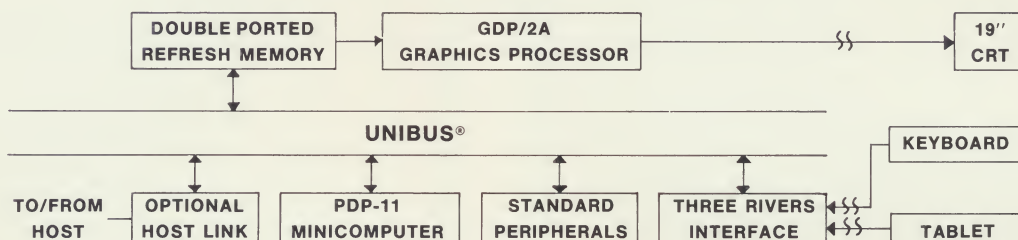
GRAPHICS PROCESSOR

The GDP/2A has an efficient instruction set to control vector intensity, XY positioning, scaling and program flow. Subroutines of picture elements may be nested to any depth. Data is formatted in one, two, or four bytes per vector for conservation of display memory space.

The processor includes a unique digital vector generator that can draw 100,000 tenth-inch vectors at a 30 Hz refresh rate (or 50,000 at 60 Hz). Completely digital vector drawing circuitry and electrostatic CRT deflection ensure perfect end-point closure between vectors and uniform intensity. Alignment and over-shoot problems common with conventional analog vector generators are eliminated.

Characters are stroke drawn and software defined with no limitations on character size, number of vectors per character, or the number of character fonts available in a picture. Special character hardware translates strings of eight-bit character codes into vector lists. Typical characters are drawn in three to five microseconds giving a capability of seven thousand characters at a 30 Hz refresh rate.

The CRT, keyboard, and tablet may be located several thousand feet from the processor equipment. The GDP/2A will drive up to four multiplexed CRTs.

REFRESH MEMORY

The double ported refresh memory may be interfaced to the PDP-11 in either of two ways. One option incorporates the memory as part of the minicomputer memory address space, allowing fast, direct manipulation of display data. The second option uses indirect addressing through an auto-incrementing address register and data register.* This option permits easy incorporation of the GDP/2A into operating systems such as UNIX®, RSTS®, and RSX-11®. With either option the double ported design keeps GDP/2A refresh traffic from slowing down the minicomputer bus.

MINICOMPUTER AND PERIPHERALS

The PDP-11 may function as a stand-alone graphics system computer or as a satellite graphics controller connected to a host computer. Any of the standard PDP-11 peripherals, in addition to a keyboard and tablet, may be connected to create an expandable graphics work station.

SOFTWARE

Three Rivers can supply both standard and custom software to meet your requirements. Our standard software includes a monitor for satellite operation as an intelligent graphics terminal; a Tekronix 4014 emulator*; and packages for incorporation into several PDP-11 operating systems. Contact us for details concerning your particular needs.

*available fourth quarter 1978

About Three Rivers . . . .

Three Rivers Computer Corporation is a manufacturer of advanced technology computer peripherals with emphasis on graphics displays. Active in computer science research and development since 1970, our engineering team has had extensive experience in applying the latest technology to new situations. This experience, coupled with practical innovation, is the foundation of Three Rivers' powerful new products for industry and research.

Incorporated in 1974, the company produces both calligraphic and raster scan computer graphics, special purpose memories, and audio conversion systems. Some brief product highlights include:

> The CVD/2, a color raster display, creates full resolution pictures from compact "run-length" encoded data. Special hardware allows variable width and height, user defined, characters to be placed anywhere on the screen. The refresh memory permits real-time animation using double buffered picture data.

> The WCS-11/40 writable control store for PDP-11/40® computers allows users to microprogram the processor to extend or modify the instruction set, emulate other computers, or speed up existing programs. Auxiliary data paths provide rotate-and-mask functions, n-way branching on data fields, and a 16-level stack for microsubroutines.

> The ADC-16 and DAC-16 audio converters provide analog-digital-analog conversion with 16-bit resolution. Designed specifically for high-fidelity audio applications, they feature 90dB dynamic range and 0.03% distortion, and are completely interfaced from studio level audio to computer bus.

Our first products, the GDP/2 and ADC/DAC-16, have been in service at installations in the U.S. and foreign countries since 1974 where they have earned an impressive reliability record. Sales of these and other units have doubled each successive year, and at our manufacturing facility we are expanding to meet the demand for our high performance products.

Three Rivers is headquartered in Pittsburgh, Pennsylvania, and maintains a close relationship with computer research communities across North America. Because of our background in human-computer interaction, we have been selected by several industrial firms to design large, special-purpose graphics systems for use by technically unskilled personnel. Our knowledge in a wide variety of computer graphics applications means we can help you select and configure a system which exactly fits your needs and budget. Call on us the next time you need peripherals that establish a new state-of-the-art.
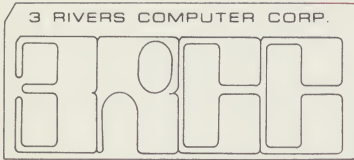
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3 RIVERS COMPUTER CORP.

GRAPHIC DISPLAY PROCESSOR

GDP/2A

Features:
*Draws 100,000 vectors
*Tree structured data
*Software defined characters

THREE RIVERS COMPUTER CORP.

GDP/2A SPECIFICATIONS

GRAPHIC DISPLAY PROCESSOR

Vector Generator

Display Method: Refreshed Calligraphic

Algorithm: Modified Digital Differential Analyzer

Addressable Points: 4096 x 4096

Viewable Points: 1024 x 1024 on 11" x 11" viewing area.

Drawing Rate: 30 ns. per point; 2 to 5.5 μsec. per inch.

Vector Drawing Time: 100 ns. minimum; 30 μsec. full screen deflection.

Maximum number of Displayed Vectors:

Length	60Hz Refresh rate	30Hz Refresh rate
0.1"	50,000	100,000
1.0"	8,250	16,500
Full Screen (11")	550	1,100

Absolute Point Positioning Time: 2.0 μsec. to any point on screen.

Endpoint Matching: Better than 0.010".

Three Vector Formats: Short - 4 bit ΔX, ΔY
Medium - 8 bit ΔX, ΔY
Long - 16 bit ΔX, ΔY (13 bits, sign extended)
All vector components are in two's complement notation.

Scaling: Vectors can be scaled by hardware to 1 of 16 scales from 1/4 to 3-1/2 times normal size in increments of approximately 20%.

Intensity Control: 16 gray levels, logarithmically spaced, gamma corrected.

Intensity Uniformity: Variation between vectors or within a given vector less than 1.4 to 1.

Character Generator

Method: Stroke drawn, software defined character set.

Character Set: Unlimited. User can define up to 256 characters per character set. Multiple sets may be used in the same picture.

Vectors per Character: No restrictions. Limited only by memory size and vector drawing time.

Character Sizes: No restrictions. A given character may be scaled by hardware vector scaling mechanism to 16 sizes.

Character Drawing Time: Typically 3-5 μsec. per character. Processing time per character = 1.1 μsec. + vector drawing time. Draw time varies with character complexity and scale.

Capacity: 3500 characters at 60 Hz. refresh rate, 7000 at 30 Hz. refresh rate with typical character set of 10-12 strokes per character.

CRT

Deflection Type: Electrostatic

Phosphor: P31 standard, others available.

Screen Size: 19" diagonal, 11" x 11" quality area.

Spot Size: 0.017" in quality area

Brightness: Greater than 15 footlamberts worst case at 60 Hz. refresh rate.

Contrast Ratio: 4:1 or greater.

Phosphor Protection: standard

Size: 16 1/2" H x 19 1/2" W x 23" D

Mounting: Free standing with tilt stand or optional rack mounting.

DOUBLE PORTED MEMORY

Capacity: 16K 16-bit words standard, 32K optional.

Cycle Time: 500ns.

Read Access Time: 350ns.

Port Compatibility:

UNIBUS™ Port: internal switches allow placement on any 8K boundary.

Graphics Port: Display Processor can make cycle requests at a sustained rate of 600ns.
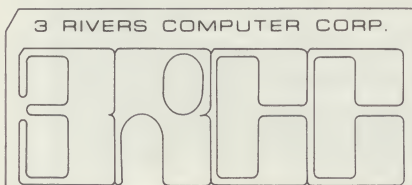
GENERAL

Data size: 16-bit word

Instruction set: Display
Jump
Subroutine Jump
Interrupt PDP-11™

Instruction Cycle Time: 600ns. except Subroutine Jump, 1.5 μsec.

Control Words: Unique bit patterns which alter vector format, intensity, scale and other mode/state registers.

Number of registers: 11

For further information, contact:

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